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1. Your reference: REVERSIBLE CORDLESS DRIVE

2. Patent application number *(The Patent Office will fill in this part)*: 0217845.7

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*:
SMART TOOLS LTD.,
BADEN POWELL RD.
KIRKTON IND ESTATE
ARBROATH
DD11 3LS
SCOTLAND

Patents ADP number *(if you know it)*: 8071102002

If the applicant is a corporate body, give the country/state of its incorporation

4. Title of the invention: REVERSIBLE CORDLESS DRIVE

5. Name of your agent *(if you have one)*:
NICK BUCHANAN,
BOOKTREE COTTAGE, NEW GILSTON, BY LEVEN, FIFE KY8 5TF

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*:
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26, Caxton Street,
London SW1H 0RJ

Patents ADP number *(if you know it)*: 03166736001

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Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*
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Reversible gearless drive

REVERSIBLE GEARLESS DRIVE

FIELD OF THE INVENTION

The present invention relates to a reversible gearless drive having a one way locking operation and more particularly, though not exclusively, concerns a tool similar in operation to a ratchet tool having a ratchet bar.

BACKGROUND OF THE INVENTION

A ratchet bar tool may be used for applying torque via an attached square drive and appropriate socket to a nut, bolt or screw (hereinafter referred to as a fastener) for the purpose of tightening or slackening the fastener. A ratchet bar is moveable relative to the socket in one direction only. Motion between the ratchet bar and the socket in the opposite direction is prevented by a set of angular teeth, which co-operate with a resilient pawl so as to create a locking motion in one direction only and free movement in the opposite direction. This operation of the socket and fastener via a ratchet bar is much more convenient in restrictive situations than the use of a fixed bar operated socket as there is seldom a requirement to remove and reattach the socket operating the fastener.

Variations of the ratchet bar are exhaustive. Most mechanisms have more and more locking teeth etc. to allow a smaller angle between drive, reposition and drive, resulting in mechanisms that whilst the angle between drive and reposition has been substantially reduced so has the amount of torque that can be safely applied to the ratchet bar without failure. The increasing intricacies of the ratchet mechanisms have also resulted in devices less tolerant to dirt or corrosion. In further embodiments, the square drive is replaced by direct socket drives on fastener drives.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an improved one way driving device.

According to the present invention there is provided a one way drive comprising a flexible head having an aperture therein for loosely engaging a drive means, a handle mounted for pivotal movement about a pivot on the head, a moveable member mounted on the head for movement into and out of the aperture in the head, and cam means located on the handle for engaging the moveable member when the handle is pivoted, such engagement moving the moveable member into the aperture so as increasingly to tighten the flexible head about the drive means as more torque is applied to the handle.

The aperture in the flexible head is preferably circular for engaging a circular drive means, such as a spigot in a socket drive. This provided an reversible gearless drive version of a conventional ratchet bar, which will grip the spigot instantly when the handle is turned in the drive direction, yet will slide relative to the spigot when the handle is turned in the reposition direction. When increasing torque is applied to the handle the action of the mechanism is to increase the locking action as more torque is applied.

Described hereinafter is an embodiment of the present invention comprising a head portion adapted to engage and apply torque to a variety of different fastener drives in order to operate fasteners. An appropriate socket square drive or fastener drive is inserted into the head portion such that the drive portion mates with the inner ring surface of the circular head aperture. Prior to use the head portion is biased in the drive direction in relation to the handle portion by a spring-loaded detent arrangement (hereinafter termed a resilient cam). When a fastener is engaged and torque arm force is applied in a pre-determined drive direction to the lever end of the handle portion, which is arranged to pivot around an axis pin via pivot points on the handle portion and pivot points on the head portion, the axis pin also mechanically holding the handle portion and the head portion together, the torque arm force applied to the lever end of the handle portion is substantially increased by the mechanical advantage of the lever action and the resultant force acts through the cam means onto the base of a clamping shoe constituting the aforementioned moveable member, thus forcing the clamping shoe inwards onto the drive means and locking the drive means between the inner ring surface and the clamping surface and the drive portion together. The torque applied to the handle portion can then operate the fastener.

To prevent undue movement between the drive means and the flexible ring, the clamping shoe can have a resilient bias towards the drive portion sustained by a resilient cam. The resilient cam continuously exerts a resilient spring pressure between the levered end of the handle and the base of the clamping shoe usefully taking up any play between the handle portion, head portion, the clamping shoe and the drive means. The resilient cam tends to propel the clamping shoe inwards towards the drive portion.

In a further embodiment of the present invention, the resilient cam acts through the handle portion and axis pin onto the inner side wall of the head portion. The resilient cam(s) being positioned perpendicular to the handle portion at the point the lever end meets the levered end.

When the head portion is biased in the drive direction relative to the handle portion, the resilient cam is moved to a position off centre relative to the shoe base or in the case of the further embodiment, off centre relative to the at rest centre line.

The resilient cam then tends to propel the handle portion in the drive direction and the drive cam is advantageously now resiliently sprung against the clamping shoe base.

When the handle portion is operated in the reverse or reposition direction the degree of clamping between the inner ring surface and the drive means is substantially decreased enabling the flexible ring to rotate, reverse or reposition relative to the drive means. Also the resilient cam is further compressed against the clamping shoe base. The strength of the resilient spring pressure exerted by the resilient cam is carefully chosen to prevent as far as possible any play between the drive portion, clamping shoe, head portion, handle portion and axis pin, yet not enough to prevent the clamping or locking action of the clamping shoe upon the drive portion being overcome allowing free movement in the reverse or reposition direction.

The reversible gearless drive can thereby be used to drive various types of novel sockets, square drives or fastener drives with considerable torque in one direction and can be conveniently reversed or repositioned in the opposite direction.

The amount of play between use in the drive and reverse directions can for all practical purposes be negligible. The size of the head portion can be much reduced as compared to conventional ratchet drives, thereby allowing easier use of the reversible gearless drive in restrictive situations. The change

between drive and reverse or reposition directions can be achieved without turning the device upside down as in any single direction device or the use of an external direction lever or switch. As the drive portion can be an integral part of the novel socket or fastener drive the overall height of the complete reversible gearless drive can be substantially reduced.

The drive portion of the drive means can quickly and advantageously be withdrawn or dropped out of the flexible ring by simply making the head portion parallel to the handle portion and if required urging the clamping shoe against the resilient cam so as to remove any clamping action from the drive portion and allow it to freely slide from the flexible ring. A release pin moveable in a slot can be provided for this purpose and a retaining ring attached to the release pin can usefully be employed to engage into a retaining groove on the drive section of the drive means to ensure that the drive section remains correctly positioned whilst being operated, yet can be quickly disengaged by the operation of the release pin.

The invention also extends to a drive means having a circular cross – section drive portion or spigot enjoyable by the above-mentioned gearless driver. At rest, the inner ring surface of the gearless driver and the clamping surface of the clamping shoe are essentially circular and parallel. The drive section of the

drive means is also circular and parallel and is able to rotate freely with a minimum of play within the flexible ring when the handle is not torqued. The clamping shoe can move lengthwise within the confines of a shoe slot within the head portion. The resilient cam(s) can be extended or compressed within a resilient cam recess within the levered end between the drive cams or as in the further embodiment at the point between the lever end and the levered end of the handle portion and if required through the axis pin.

DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will now be described by way of example with reference to the accompanying drawings in which:

Fig 1 shows in perspective the reversible gearless drive biased in an anticlockwise direction and engaged on a type of fastener, the stud of the fastener protruding through the centre of the novel socket.

Figs. 2a and **2b** illustrate in perspective top and bottom views of the reversible gearless drive biased in an anticlockwise direction.

Figs. 3a, 3b and **3c** show in profile different states of the reversible gearless drive without the drive portion within the inner ring surface.

Figs. 4a, 4b and **4c** show in section different states of the reversible gearless drive without the drive portion within the inner ring surface. Figs. 4a and 4c showing the reversible gearless drive biased anticlockwise (4a) and clockwise (4c) and the resilient cam being shown extended parallel to the handle portion and off centre on the clamping shoe which is protruding into the inner ring.

Figs. 5a, 5b and **5c** show the reversible gearless drive as in Figs 4a, 4b and 4c but in perspective.

Figs 6a, 6b and **6c** show in section a further embodiment of the present invention whereby the resilient cam (5) is shown in Figs. 6a and 6c extended from the confines of the resilient cam recess (3d) perpendicular to the handle portion (3) against the head portion inner side wall (2h). Fig. 6b illustrates the resilient cam (5) compressed by the inner side wall (2h).

Fig. 7 illustrates a dismantled reversible gearless drive.

Fig. 8 shows a reversible gearless drive, a novel socket and a release pin.

Figs. 9a through to **9h** illustrate several variations of novel sockets, square drives and other fastener drives.

Fig. 10 shows in **Fig. 10a** the reversible gearless drive in perspective with a retaining pin shown on the clamping shoe, and in **Fig. 10b** the reversible gearless drive in section with a retaining pin shown on the clamping shoe.

Fig. 11 shows the reversible gearless drive in perspective with a novel socket within the inner ring surface, the novel socket (also shown in top and bottom perspective views) being retained within the inner ring surface by a release pin retaining ring within a retaining groove.

Figs. 12a, 12b and **12c** illustrates the further embodiment of the reversible gearless drive (1) wherein the drive means (4) are removed. In **Fig. 12a** and **12c,** the clamping surface (7c) of the clamping shoe (7) protrudes into the inner ring (2i). **Fig. 12b** shows the reversible gearless drive (1) at rest the clamping shoe (7) withdrawn into the shoe slot (2c).

Figs. 13a, 13b and **13c** illustrate the further embodiment of the reversible gearless drive (1) wherein **Figs. 13a and 13c** there are sockets (8) within the inner ring (1). **Fig. 13b** shows a square drive (9) fitted within the inner ring.

REFERENCE NUMERALS OF THE EMBODIMENTS

With reference to the drawings various embodiments will be given reference numerals.

(1)	Reversible gearless drive	(5b)	Compression spring
(2)	Head portion	(6)	Axis pin
(2a)	Flexible ring	(6a)	Resilient cam recess
(2b)	Inner ring surface	(6b)	At rest centre line
(2c)	Shoe slot	(7)	Clamping shoe
(2d)	Pivot points	(7a)	Centre line
(2e)	Release pin slot	(7b)	Base
(2f)	Handle slot	(7c)	Clamping surface
(2g)	Side wall	(7d)	Release pin hole
(2h)	Inner side wall	(7e)	Retaining pin
(2i)	Inner ring	(8)	Socket
(3)	Handle portion	(8a)	Retaining groove
(3a)	Lever end	(8b)	Through hole
(3b)	Levered end	(9)	Square drives
(3c)	Drive cams	(10)	Fastener
(3d)	Resilient cam recess	(11)	Release pin
(3e)	Perpendicular centre line	(11a)	Retaining ring
(3f)	Handle centre line	(12)	Fastener drives
(4)	Drive portion		
(5)	Resilient cam	(D)	Drive direction
(5a)	Ball bearing	(R)	Reverse direction

DESCRIPTION OF THE EMBODIMENTS

The embodiments of the present invention will now be described with reference to the drawings. In various embodiments and corresponding drawings like reference numerals will be used to indicate like features.

Referring now to the drawings, the reversible gearless drive (1) consists of a head portion (2) with a flexible ring (2a) with an inner ring surface (2b) and a shoe slot (2c) contained within the side wall (2g) having an inner side wall (2h). A handle portion (3) is mechanically connected by an axis pin (6) to the head portion (2), the handle portion (3) swivelling within a handle slot (2f). The handle portion (3) consists of a lever end (3a) and levered end (3b), drive cams (3c), perpendicular centre line (3e) and a resilient cam recess (3d). The drive portion (4) within the flexible ring (2a) is clamped when used in the drive direction (D) by a clamping shoe (7) operated by the appropriate drive cam (3c) acting on the base (7b) of the clamping shoe (7) within the shoe slot (2c). Moving the clamping surface (7c) against the drive portion (4) causes the flexible ring (2a) to flex thereby increasing the inner ring surface (2b) area in intimate contact with the drive portion (4) and clamping and locking the drive portion (4) within the flexible ring (2a). The torque applied to the handle

portion (3) is now all transmitted to the socket (8), square drives (9) or fastener drives (12) in order to drive a fastener (10).

The reversible gearless drive (1) in use is first biased in the drive direction (D) wherein the resilient cam (5) is positioned on the right hand side of the base (7b) centre line (7a) when the drive direction (D) is clockwise. The resilient cam (5) is positioned on the left-hand side of the base (7b) centre line (7a) when the drive direction (D) is anti-clockwise. The resilient cam (5) preferably consists of a ball bearing (5a) and compression spring (5b) freely moveable within a resilient cam recess (3d) within the handle portion (3) and within a resilient cam recess (6a) within the axis pin (6). In a further embodiment of the present invention, the resilient cam (5) and resilient cam recess (3d) are positioned between the lever end (3a) and levered end (3b) on the centre line (3c) perpendicular to the handle portion (3). In the reverse or reposition direction (R), the resilient cam (5) takes up any play between the head portion (2), handle portion (3), axis pin (6) and clamping shoe (7). In order to conveniently remove the drive portion (4) from the confines of the flexible ring (2a) there can be provided a release pin (11) operated within a release pin slot (2e) and retained within the release pin hole (7d) within the clamping shoe (7). To keep the drive portion (4) in its optimum position relative to the inner ring surface (2b), the release pin (11) has a retaining ring

(11a) which can engage and disengage with a corresponding retaining groove (8a) on the novel socket (8), square drive (9) or fastener drive (12). Alternatively, they may be retained within the flexible ring (2a) by a retaining pin (7e) on the clamping surface (7c) of the clamping shoe (7). The novel socket (8) preferably has a through – hole (8b) to usefully allow the stud or threaded portion of a fastener (10) to protrude through the centre of the novel socket (8).

The inner surface (2b), the gripping surface of the drive portion (4) and the clamping surface (7c) of the clamping shoe (7) are preferably all a fine smooth finish.

Preferably, the axis pin (6) is retained by known means within the handle portion (3), whilst allowing the head portion (2) to pivot freely in relation to the handle portion (3) without undue play.

The reversible gearless drive (1) comprising head portion (2) is adapted to engage and apply torque to a variety of different fasteners drives (12), (9) and (8) in order to operate fasteners (10). The appropriate socket (8), square drive (9) or fastener drive (12) is inserted into the head portion (2) such that the drive portion (4) mates with the inner ring surface (2b). Prior to use the head

portion (2) is biased in the drive direction (D) in relation to the handle portion (3). When a fastener (10) is engaged and torque arm force is applied in a predetermined drive direction (D) to the lever end (3a) of the handle portion (3), the handle pivots around the axis pin (6) via pivot points (3d) on the handle portion (3) and pivot points (2d) on the head portion (2), the axis pin (6) mechanically holding the handle portion (3) and the head portion (2) together. The torque arm force applied to the lever end (3a) of the handle portion (3) is substantially increased by the mechanical advantage of the lever action and the resultant force acts through the appropriate drive cam (3c) on to the base of the clamping shoe (7). This forces the clamping shoe inwards onto the drive portion (4), thereby locking the drive portion (4) between the inner ring surface (2b) and the clamping surface (7c) of the shoe (7). The flexible ring (2a) of the head portion (2) flexes to allow the inner ring surface (2b) to maximise its gripping surface on the drive portion (4). This clamping and locking serves to lock the flexible ring (2a), clamping surface (7c) and drive portion (4) together. The torque applied to the handle portion (3) can then be usefully used to operate the fastener (10). To usefully prevent undue slippage between the drive portion (4) and the flexible ring (2a) the clamping shoe (7) has a resilient bias upon the drive portion (4) which is sustained by the resilient cam(s) (5).

When the head portion (2) is biased in the drive direction (D) relative to the handle portion (3) the resilient cam (5) is moved to a position off centre relative to the shoe base (7b) or in the case of the further embodiment off centre relative to the at rest centre line (6b). The resilient cam (5) then tends to propel the handle portion (3) in the drive direction (D) and the drive cam (3c) is advantageously now resiliently sprung against the clamping shoe base (7b). When the handle portion (3) is operated in the reverse or reposition (R) direction, the degree of clamping between the inner ring surface (2b) and the drive portion (4) is substantially decreased thereby enabling the flexible ring (2a) to rotate, reverse or reposition relative to the drive portion (4).

The resilient cam (3c) continuously exerts a resilient spring pressure between the levered end (3a) of the handle (3) and the base (7b) of the clamping shoe (7), usefully taking up any play between the handle portion (3), head portion (2), the clamping shoe (7) and the drive portion (4). The resilient cam (5) tends to propel the clamping shoe (7) inwards towards the drive portion (4). When the levered end (3b) of the handle portion is operated in the reverse or reposition direction (R) the resilient cam (5) is further compressed against the clamping shoe base (7b) or in the case of the further embodiment against the inner side wall (2h). The strength of the resilient spring (5b) pressure exerted by the resilient cam (5) is carefully chosen to prevent as far as possible any

play between the drive portion (4), clamping shoe (7), head portion (2), handle portion (3) and axis pin (6), yet not enough to prevent the clamping or locking action of the clamping shoe (7) upon the drive portion (4) being overcome so as to allow free movement in the reverse or reposition direction.

The reversible gearless drive (1) can thereby be used to drive various types of novel sockets (8), square drives (9) or fastener drives (12) with considerable torque in one direction (D) and to be conveniently reversed or repositioned (R) in the opposite direction.

The amount of play between use in the drive (D) or reverse (R) directions is for all practical purposes negligible. The size of the head portion (2) is much reduced allowing easier use of the reversible gearless drive (1) in restrictive situations. The change between drive (D) and reverse or reposition (R) directions can be achieved without turning the device upside down as in any single direction device or the requirement of an external direction lever or switch. As the drive portion (4) can be an integral part of the novel socket (8) or fastener drive (12) the overall height of the complete reversible gearless drive (1) is substantially reduced.

The drive portion (4) of the novel socket (8), square drive (9) or fastener drive (12) can quickly and advantageously be withdrawn or dropped out of the flexible ring (2a) by centralising the handle portion (3) relative to the head portion (2) and if fitted moving the release pin (11) within the release pin slot (2e). This detents the clamping (7) and compresses the resilient cam (5) so removing any clamping action from the drive portion (4) and allowing the drive portion (4) to freely slide from the flexible ring (2a). A retaining ring (11a) attached to the release pin (11) can usefully be employed to engage into a retaining groove (8a) on the drive section (4) of the novel socket (8), fastener drive (12) or square drive (9) to ensure that the drive section (4) remains correctly positioned whilst being operated and yet can be quickly disengaged by the operation of the release pin (11). At rest the inner ring surface (2b) and the clamping surface (7c) are essentially circular and parallel. The complimentary drive section (4) is also circular and parallel, the drive section (4) being able to rotate freely with a minimum of play within the confines of the shoe slot (2c) within the flexible ring (2a). The clamping shoe (7) can move lengthwise within the confines of the shoe slot (2c) within the head portion (2). The resilient cam (5) can be extended or compressed within the resilient cam recess (3d) within the levered end between the drive cam or in the case of the further embodiment the resilient cam recess (3d) is through

the axis pin resilient cam recess (6a) and the centre line (3e) which is perpendicular to the handle centre line (3f).

CLAIMS

1. A one way drive comprising a flexible head having an aperture therein for loosely engaging drive means, a handle mounted for pivotal movement about a pivot on the head, a moveable member mounted on the head for movement into and out of the aperture in the head, and cam means located on the handle for engaging the moveable member when the handle is pivoted, such engagement moving the moveable member into the aperture so as increasingly to tighten the flexible head about the drive means as more torque is applied to the handle.

2. A drive as claimed in claim 1., wherein the moveable member is slidably mounted on the head.

3. A drive as claimed in claim 2., wherein the moveable member has a surface which constitutes a part of the surface of the aperture in the head.

4. A drive as claimed in any preceding claim wherein the cam means comprises a shoulder provided on at least one side of the handle, relative to a longitudinal axis of the handle, between the pivot and the moveable member.

5. A drive as claimed in claim 4., wherein the cam means comprises two shoulders one on each side of the handle.

6. A drive as claimed in any preceding claim, wherein the cam means comprises a resilient cam including a ball bearing and spring means located in a recess in the handle.

7. A drive as claimed in claim 6., wherein the recess which receives the spring means extends into the pivot about which the handle is pivotable.

8. A drive as claimed in claim 6 or 7, wherein the recess which receives the ball bearing and spring means lies coaxial with the longitudinal axis of the handle.

9. A drive as claimed in claim 6, 7 or 8, wherein the spring means comprises a compression spring.

10. A drive as claimed in any preceding claim, including an elongate slot in the head, a retaining pin located in the slot for retaining fastening means within the aperture in the head.

11. A drive as claimed in claim 10. including a retaining ring located between a head of the retaining pin and head of the gearless drive.

12. A drive as claimed in claim 10 or 11, wherein the retaining pin is slidable along the slot for engaging or releasing fastening means in the aperture of the head of the gearless drive.

13. A drive as claimed in any preceding claim, wherein the fastening means comprises a fastener as already mentioned beforehand.

14. A drive as claimed in any of the claims 1 to 12, wherein the fastening means comprises a drive socket mounted in the gearless drive for engaging a fastener as already mentioned beforehand.

15. A drive as claimed in any of the claims 1 to 9, comprising a detent projecting outwardly from the moveable member into the aperture in the head so as to engage in a groove in fastening means located in the aperture in the head of the gearless drive to retain the fastening means in the aperture.

16. A drive as claimed in any preceding claim wherein the aperture in the head is circular.

17. Drive means for use with a drive as claimed in any of the preceding claims.

18. A gearless drive device substantially as mentioned hereinbefore described with reference to, and as illustrated in Figs. 1 to 8; or Figs. 9 to 13 of the accompanying drawings.

19. Drive means comprising a circular – section spigot extending coaxially from a tool engageable with fastening means.

20. Drive means as claimed in claim 19 and substantially as herein described with reference to the accompanying drawings.

ABSTRACT

A REVERSIBLE GEARLESS DRIVE

A head portion (2) and handle portion (3) pivot around an axis pin (6). The head portion (2) is first biased in the required (D) direction bias being sustained by the resilient cam (5) being over the clamping shoe (7) centre line (7a). When torque is applied in the drive direction (D) to the levered end (3a) the resultant forces acts through the pertinent cam (3c) on the levered end (3b) forcing the clamping shoe (7) inwards locking the inner surface (2b) and clamping surface (7c) onto the drive portion (4) of a socket (8) or circular drive (9) in order to operate a fastener (10). A spring cam (5) takes up any play between the handle portion (3), head portion (2), axis pin (6), clamping shoe (7) and drive portion yet compresses sufficiently to allow the reversible gearless drive (1) relative to the drive portion (4) to be repositioned (R). The clamping shoe (7) is a sliding fit within the shoe slot (2c) can be conveniently operated against the resilient cam (5) by a release pin (11) within an appropriate slot (2e).

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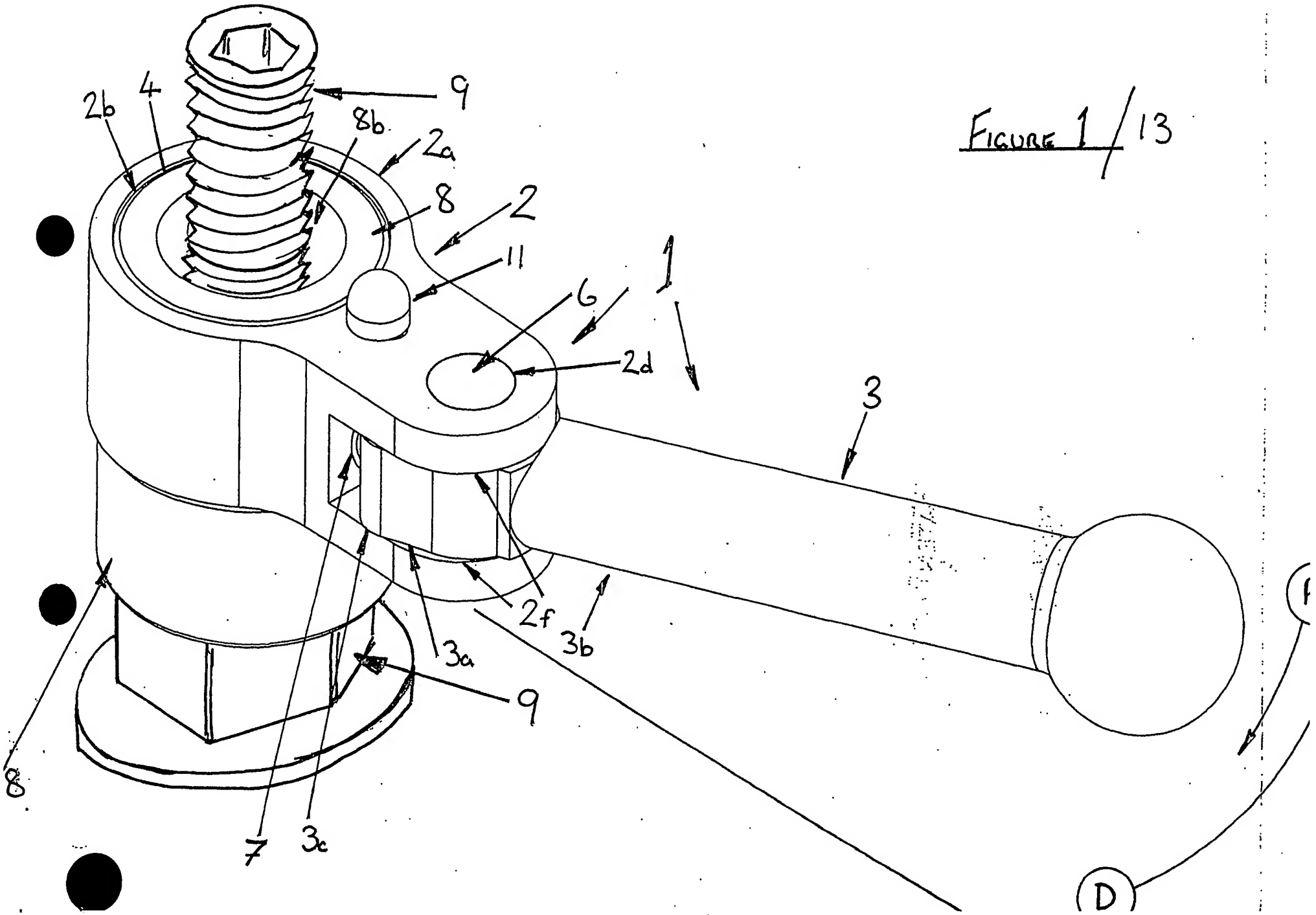

FIGURE 1/13

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FIGURE 2/13

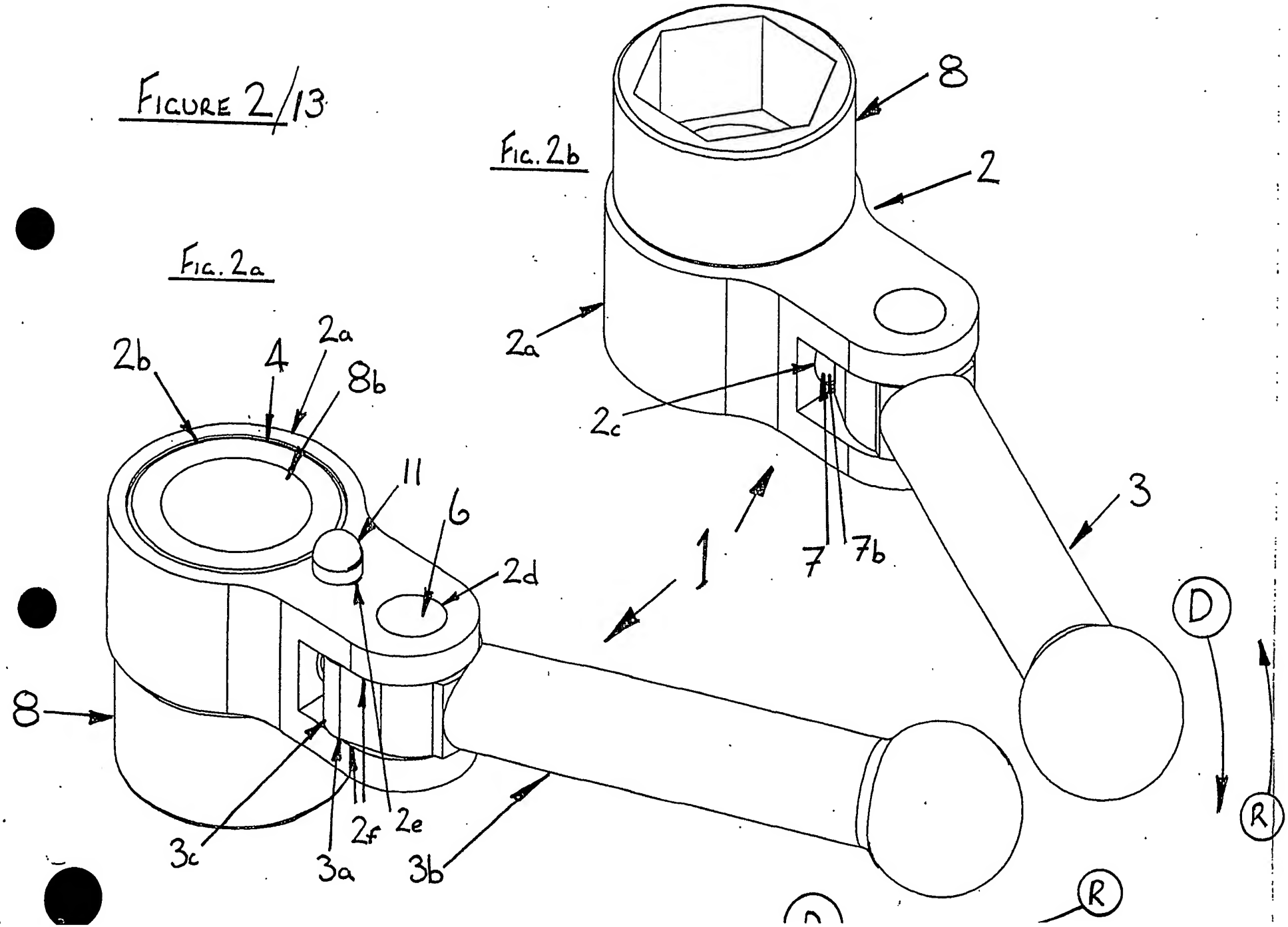

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Fig. 3a

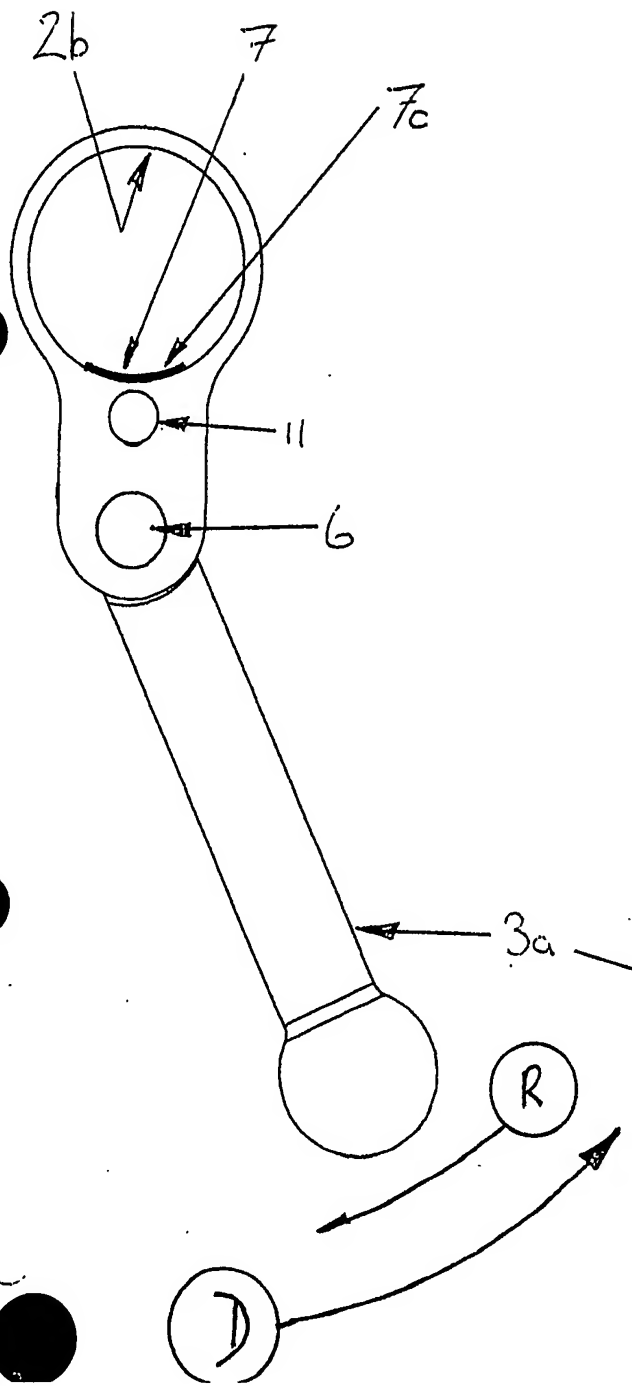

Fig. 3b

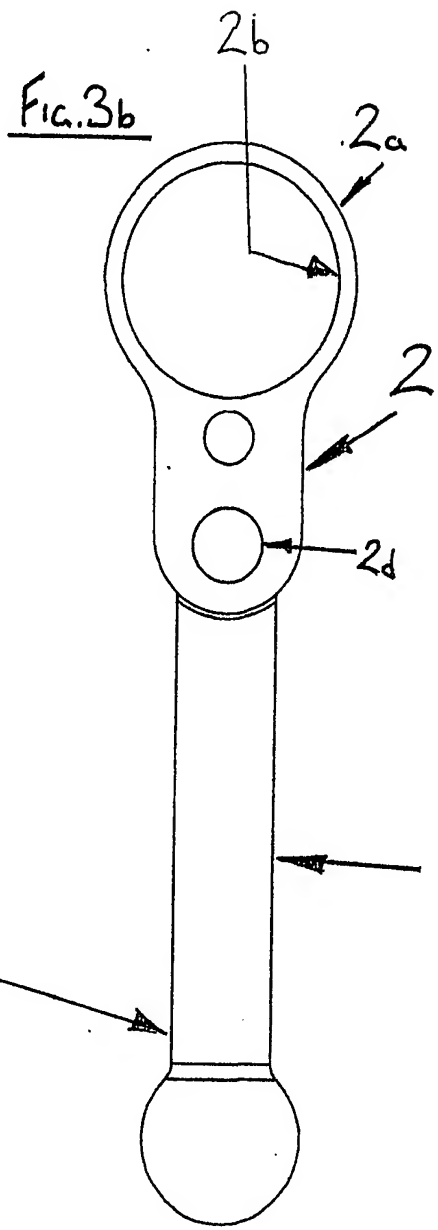

Fig. 3c

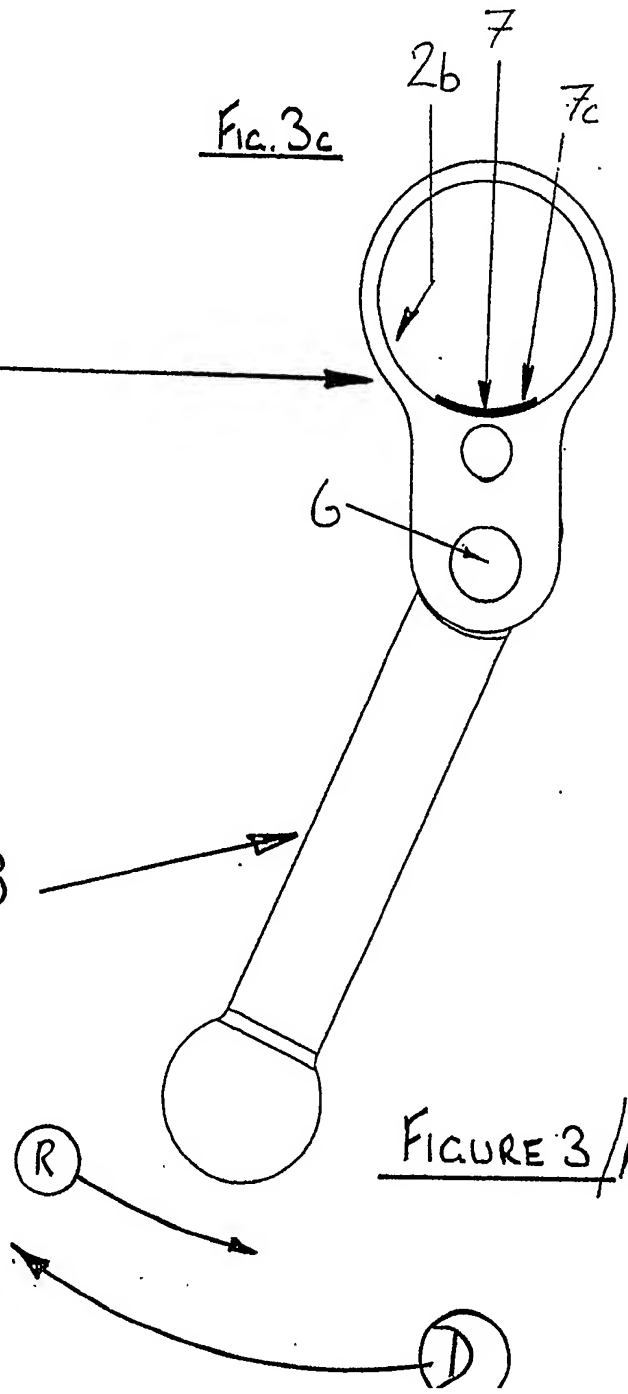

FIGURE 3/13

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Fig. 4a

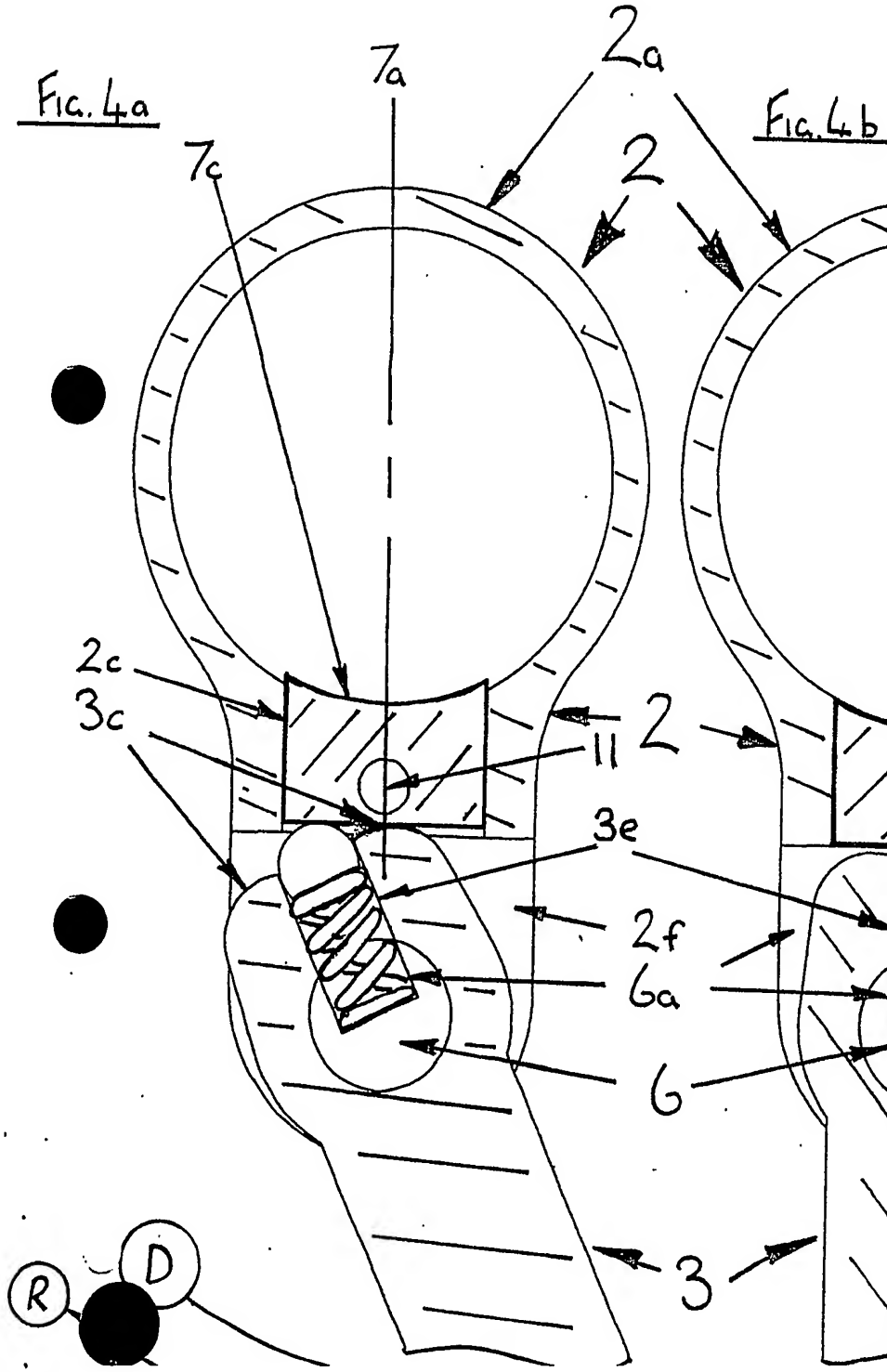

Fig. 4b

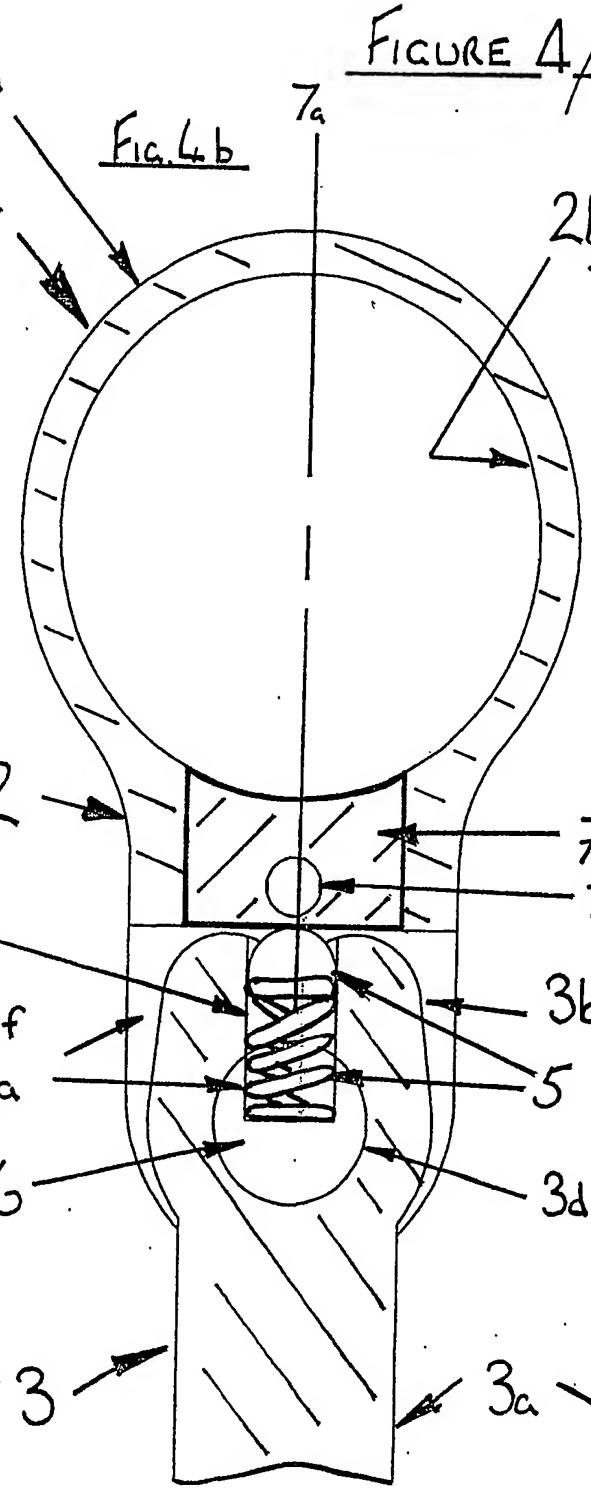

Fig. 4c

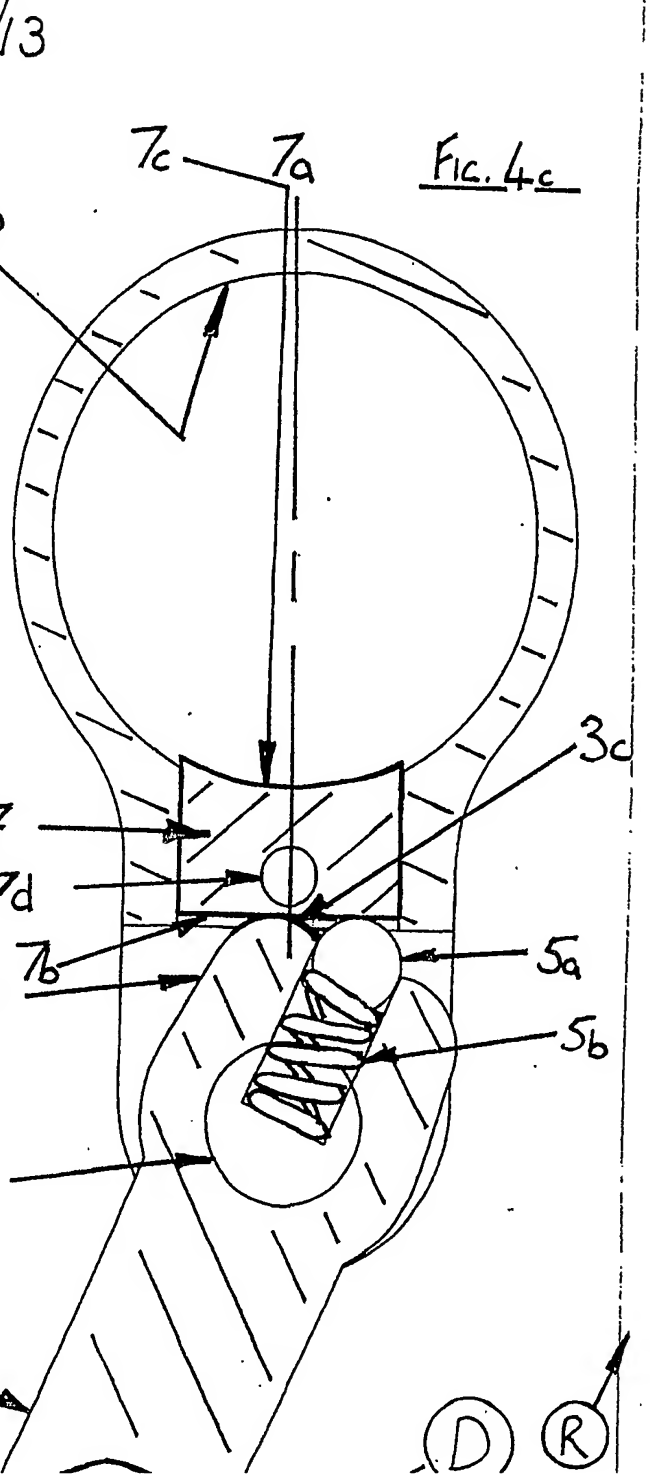

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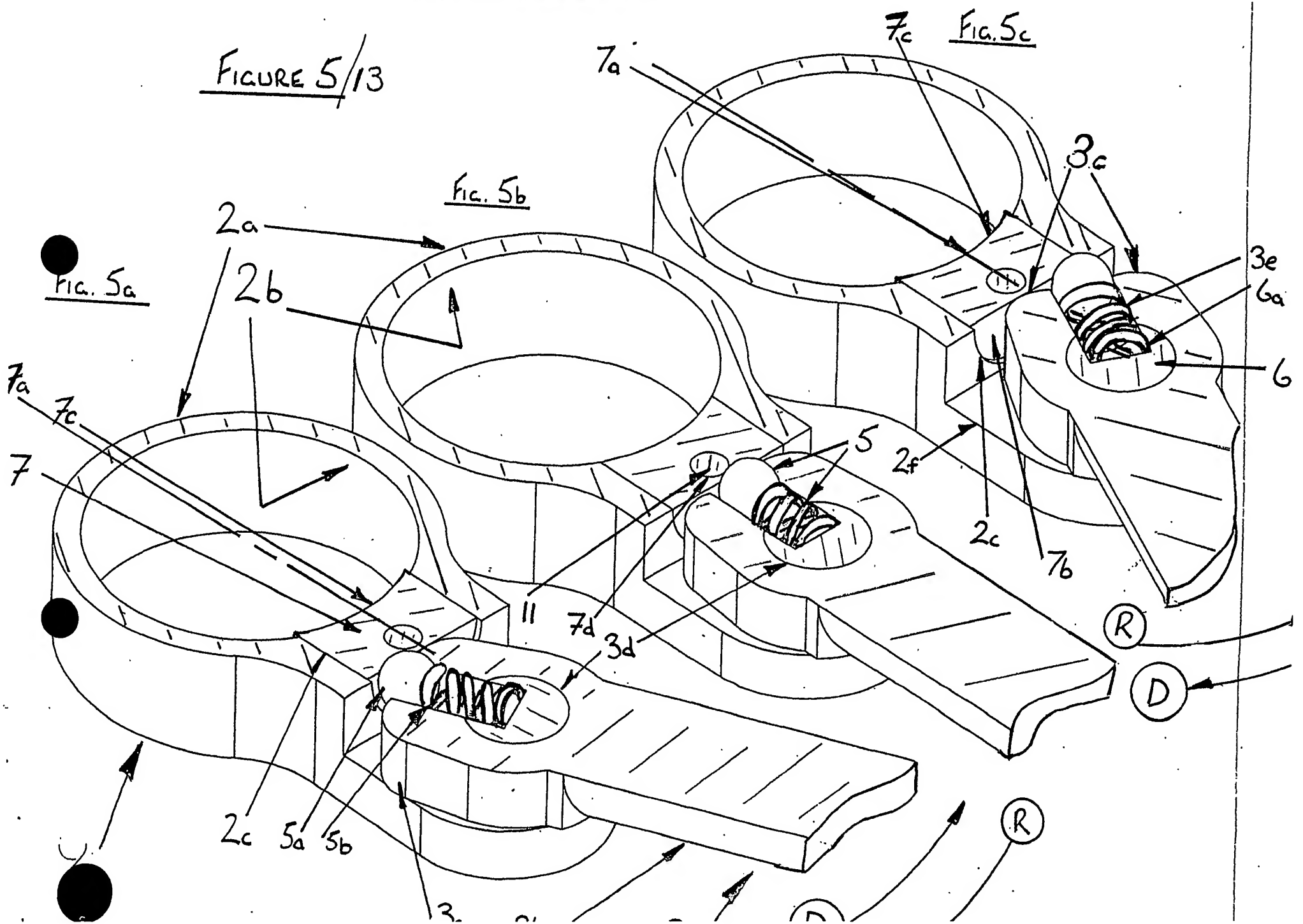
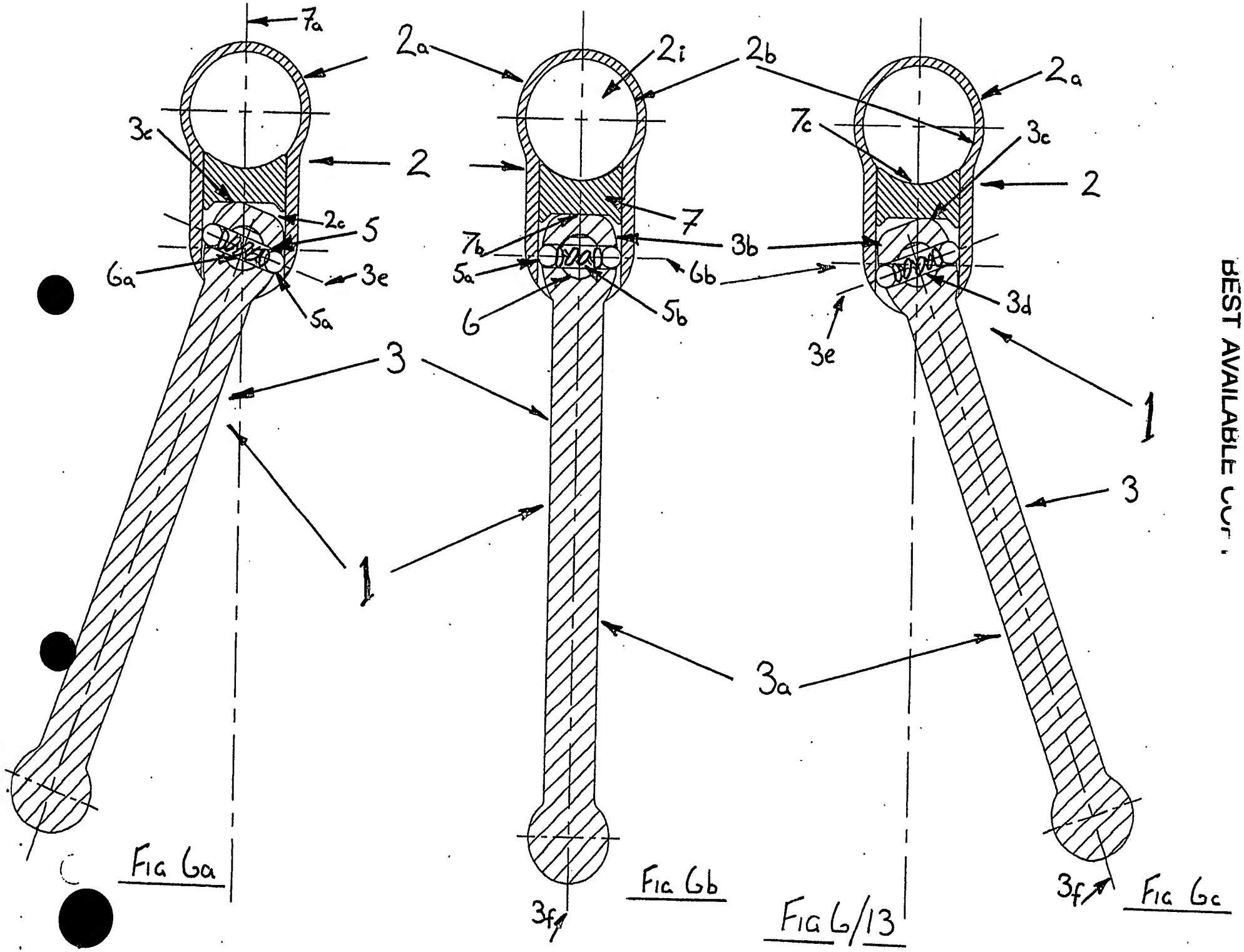
FIGURE 5/13





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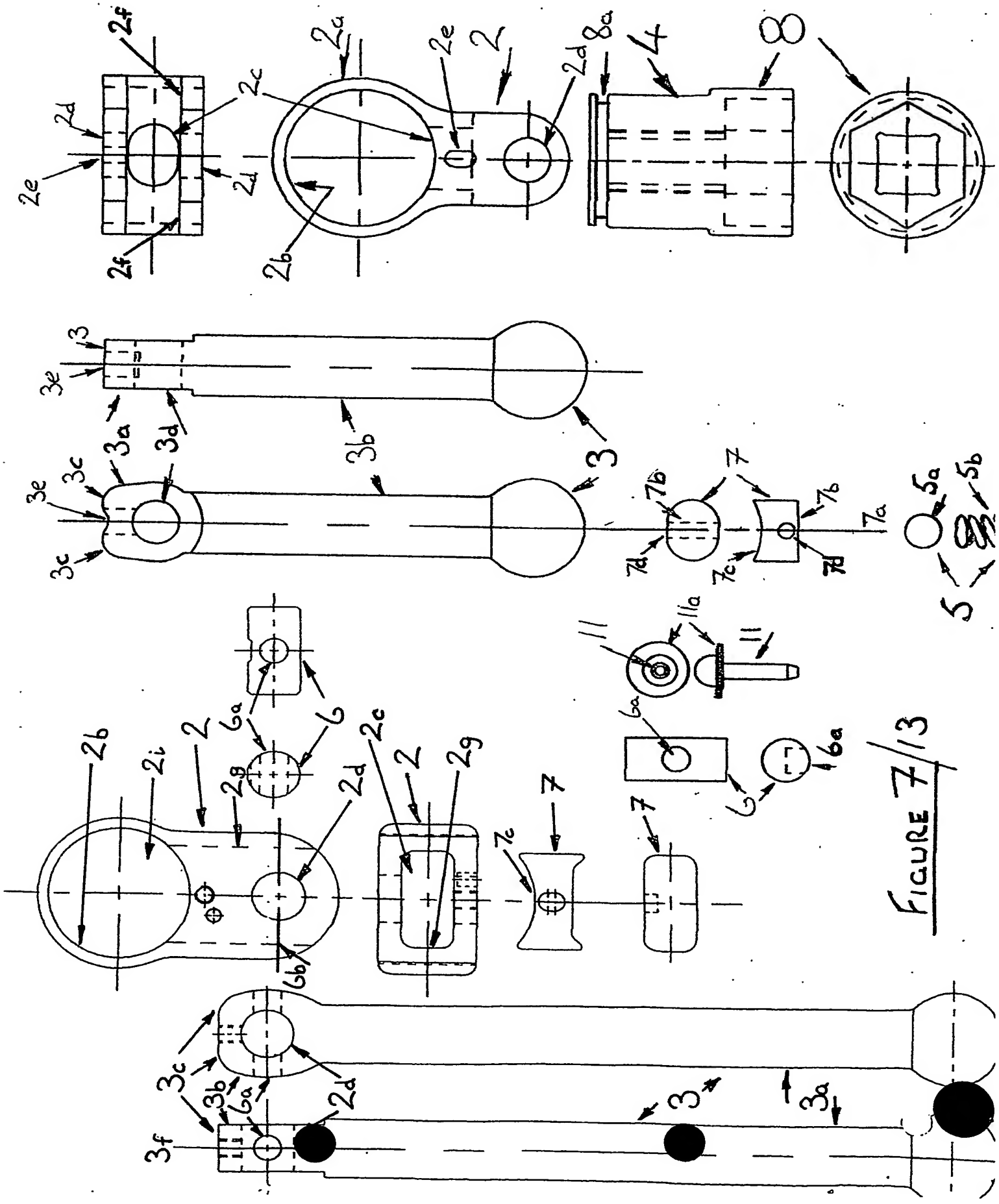


FIGURE 7/13

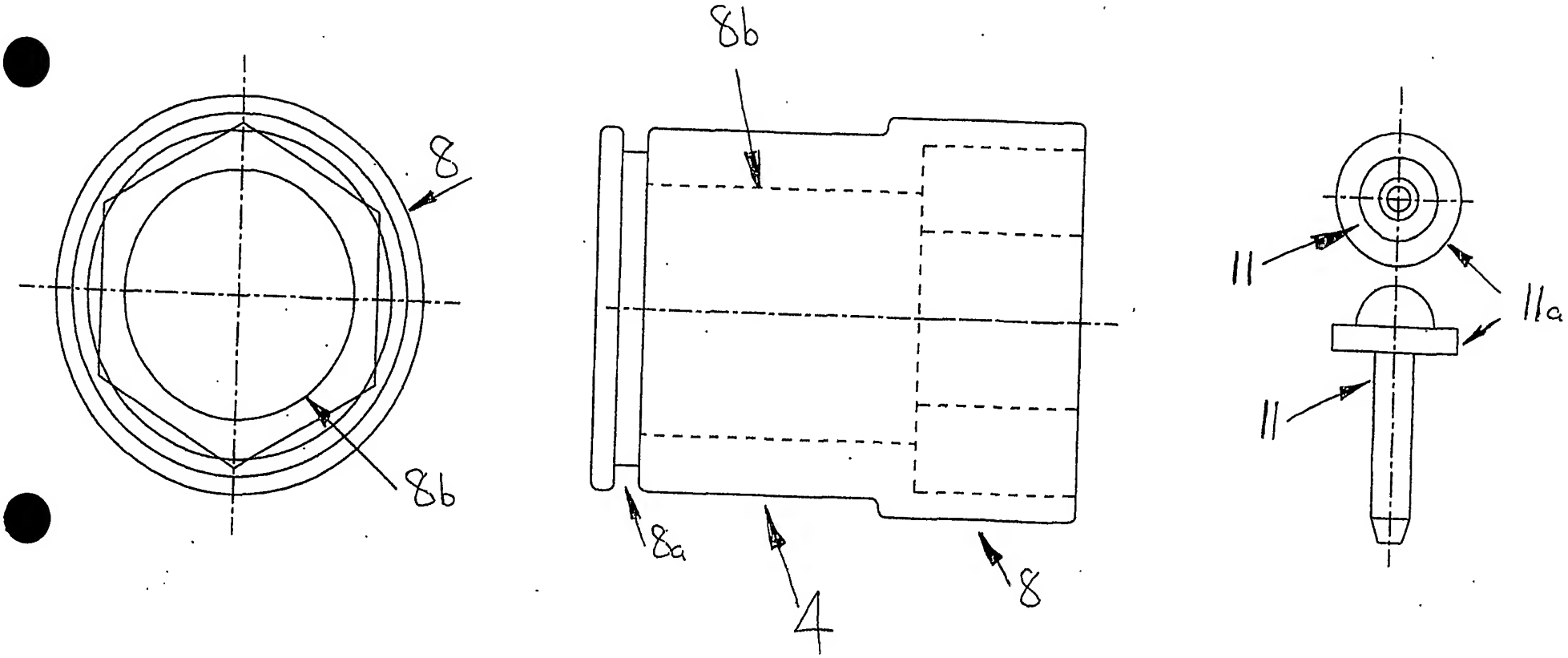


FIGURE 8/13

FIGURE 9/13

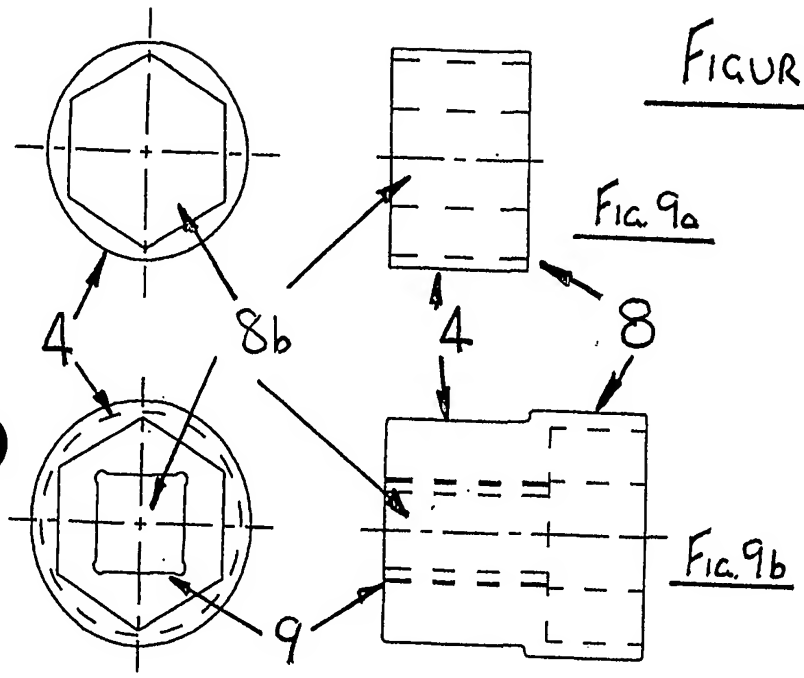


FIG. 9a

FIG. 9b

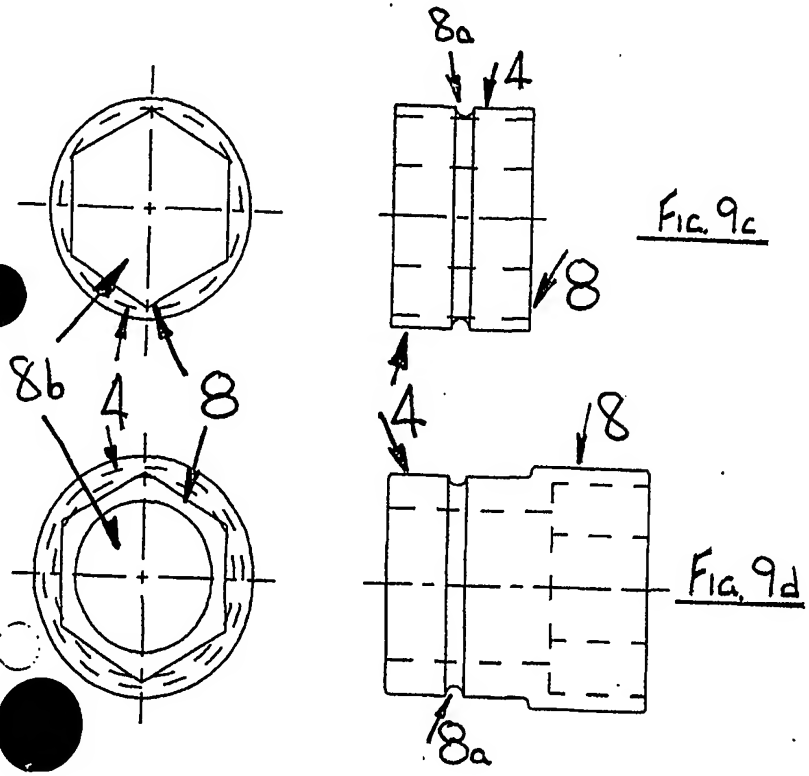


FIG. 9c

FIG. 9d

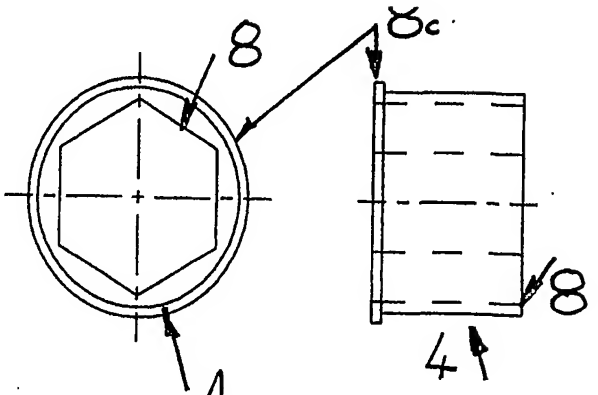


FIG. 9e

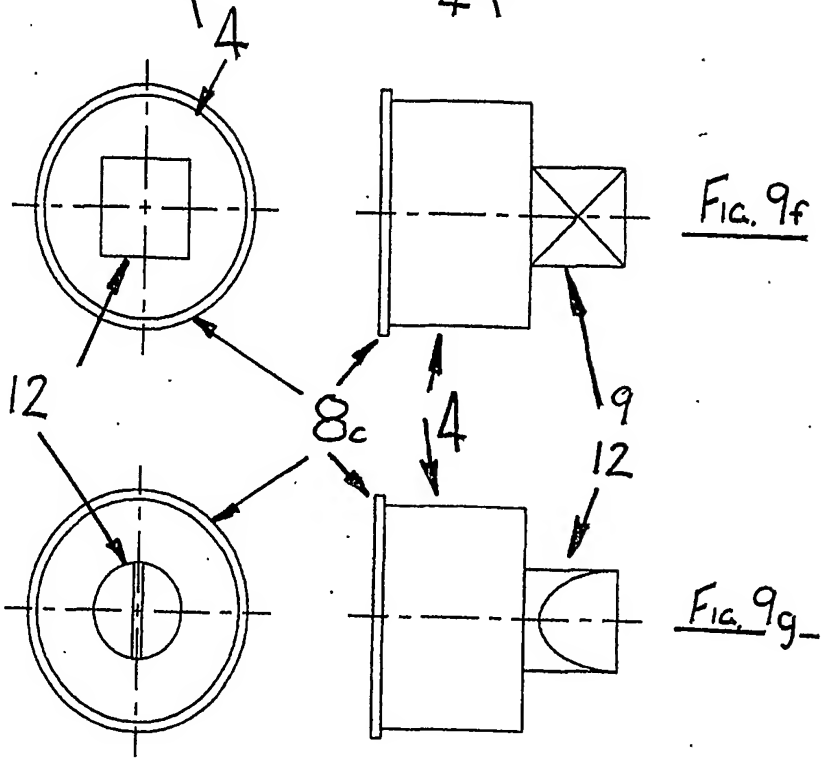


FIG. 9f

FIG. 9g

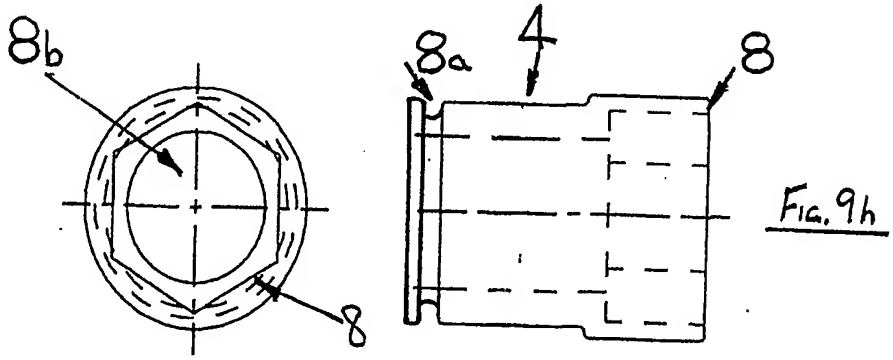


FIG. 9h

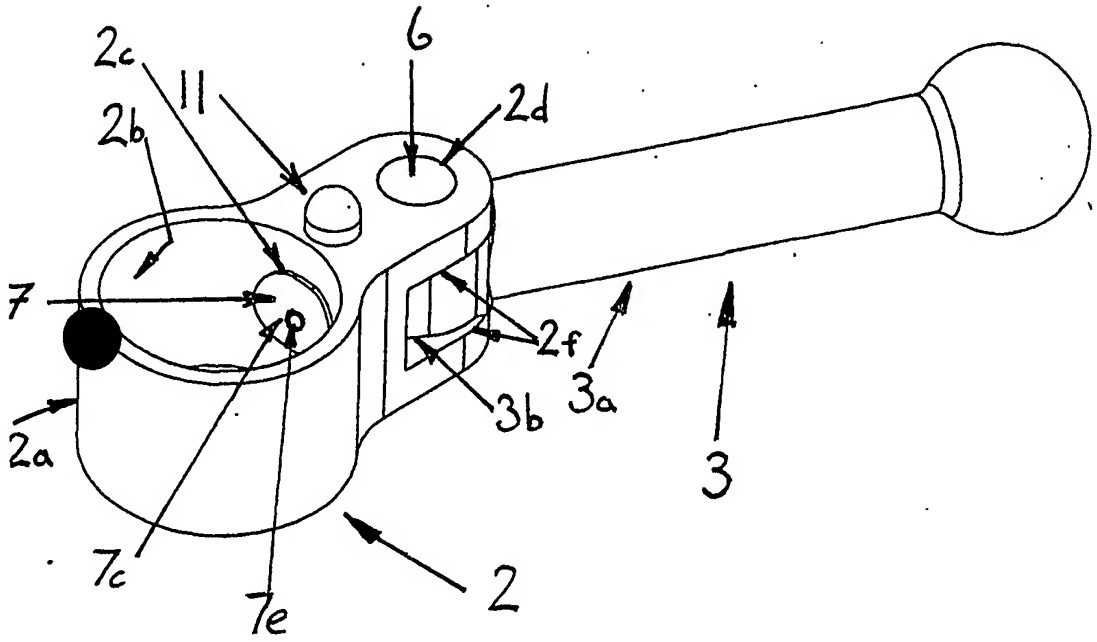


Fig.10a

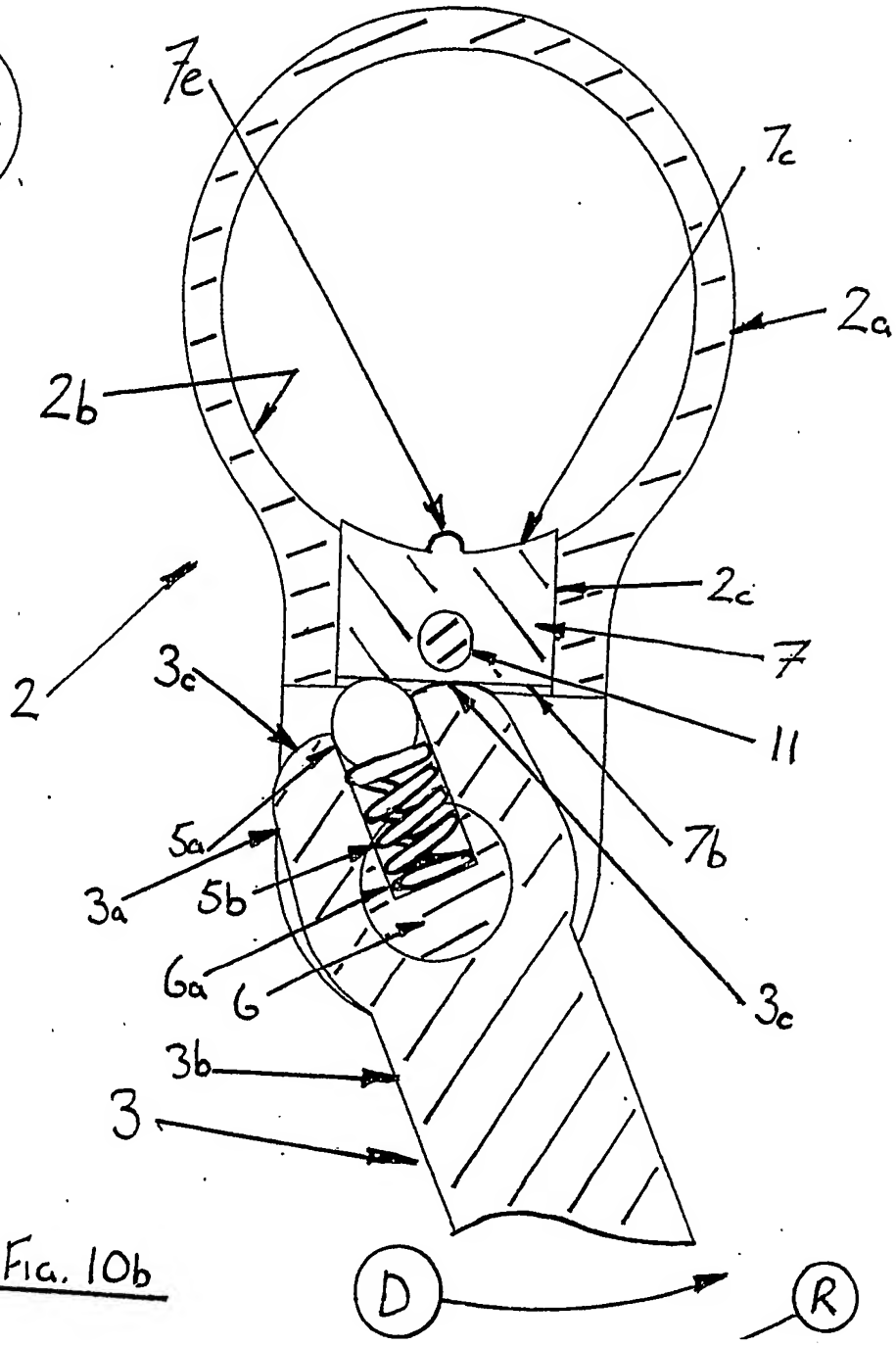
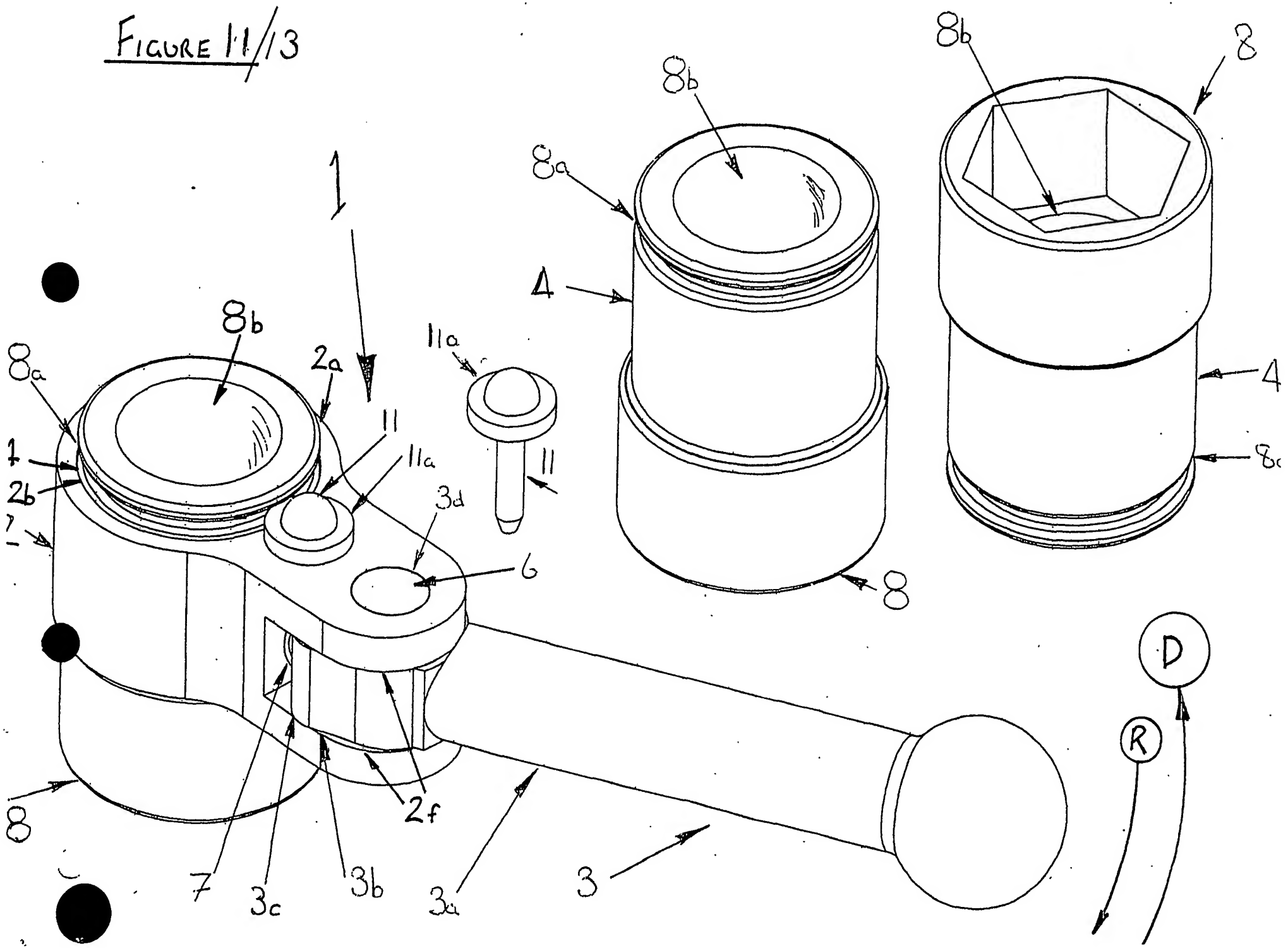


Fig. 10b

FIGURE 10/13

FIGURE 1/1/3



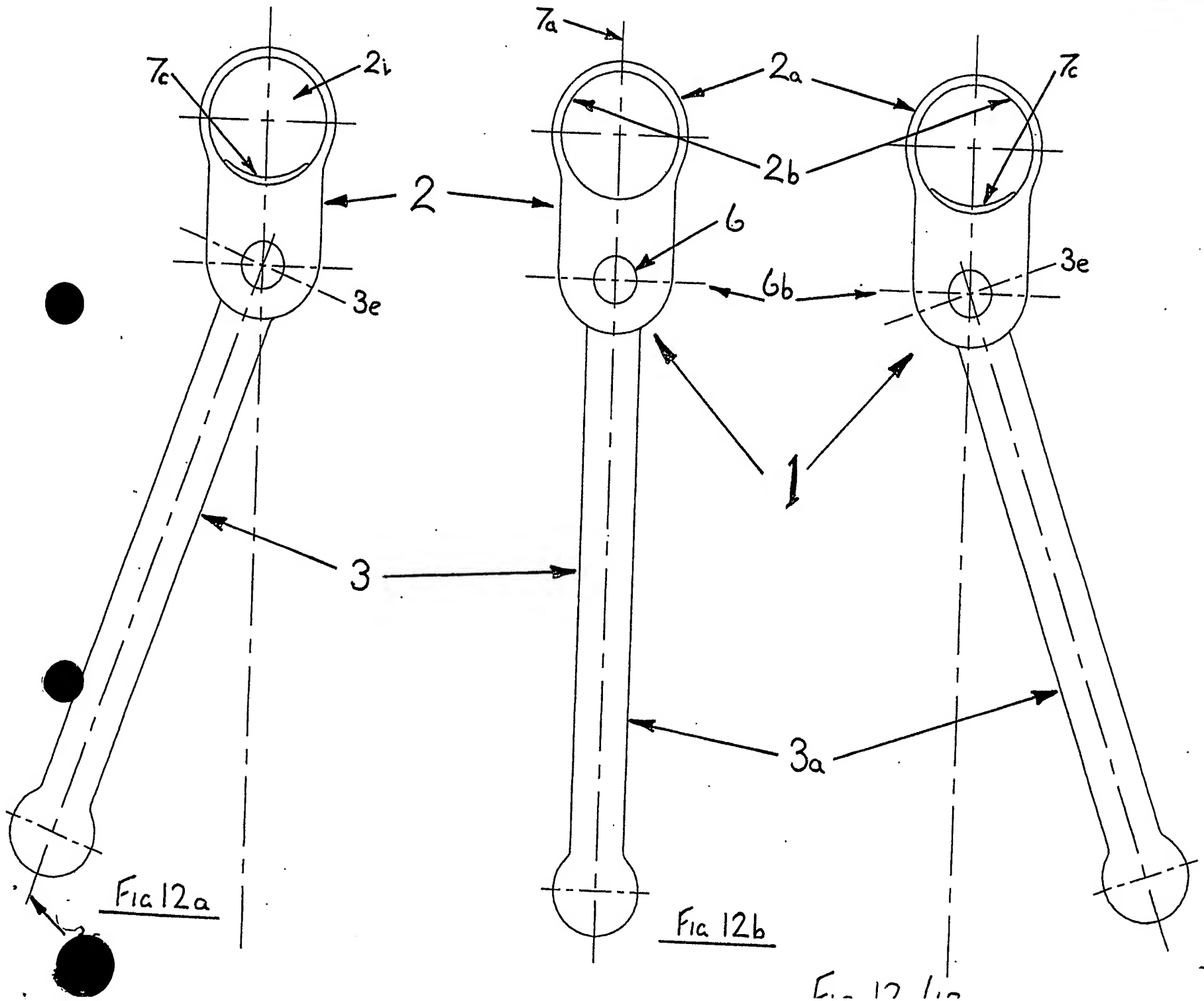


Fig 12a

Fig 12b

Fig 12c

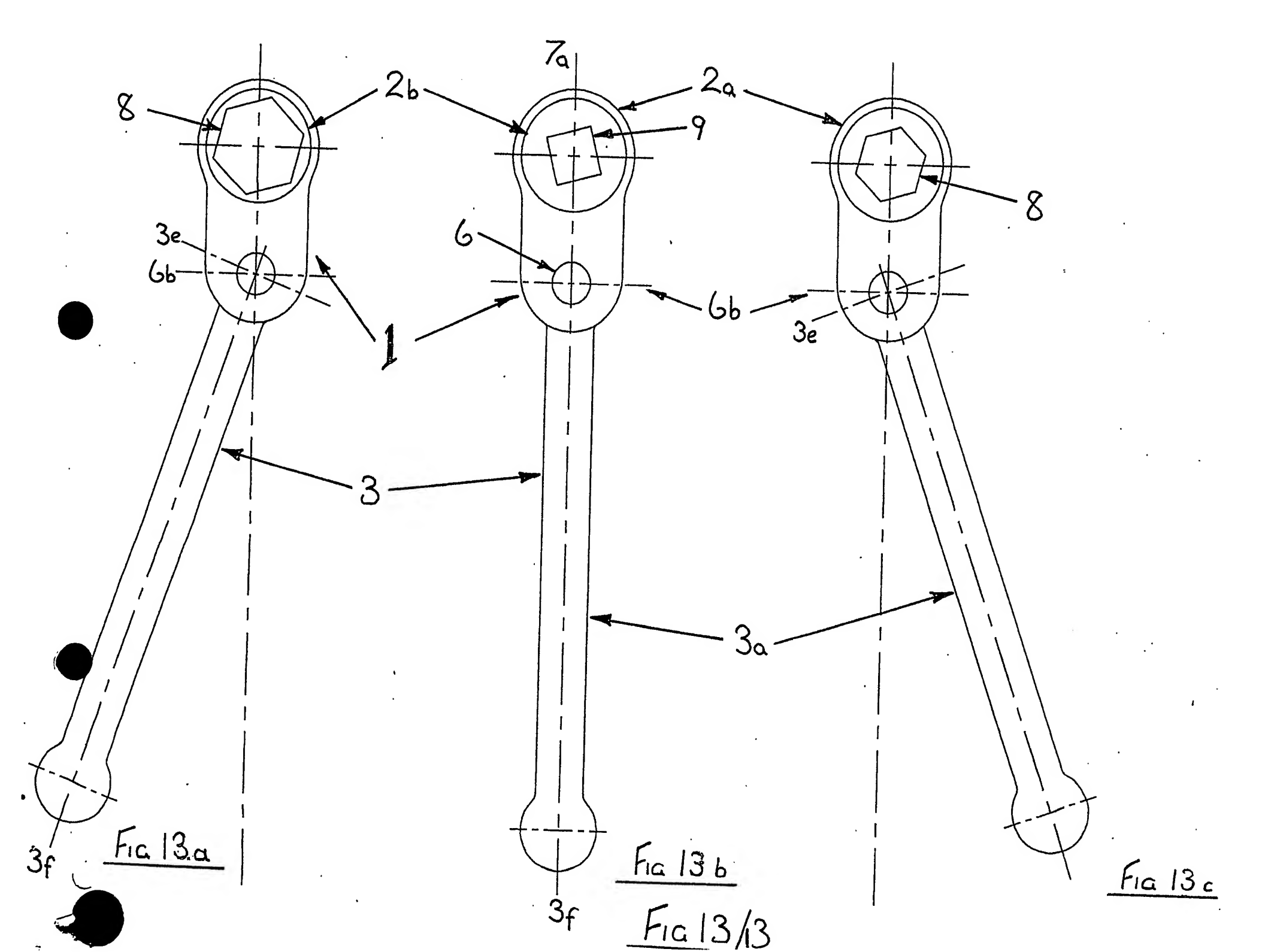


Fig 13a

Fig 13b

Fig 13c

Fig 13/13

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